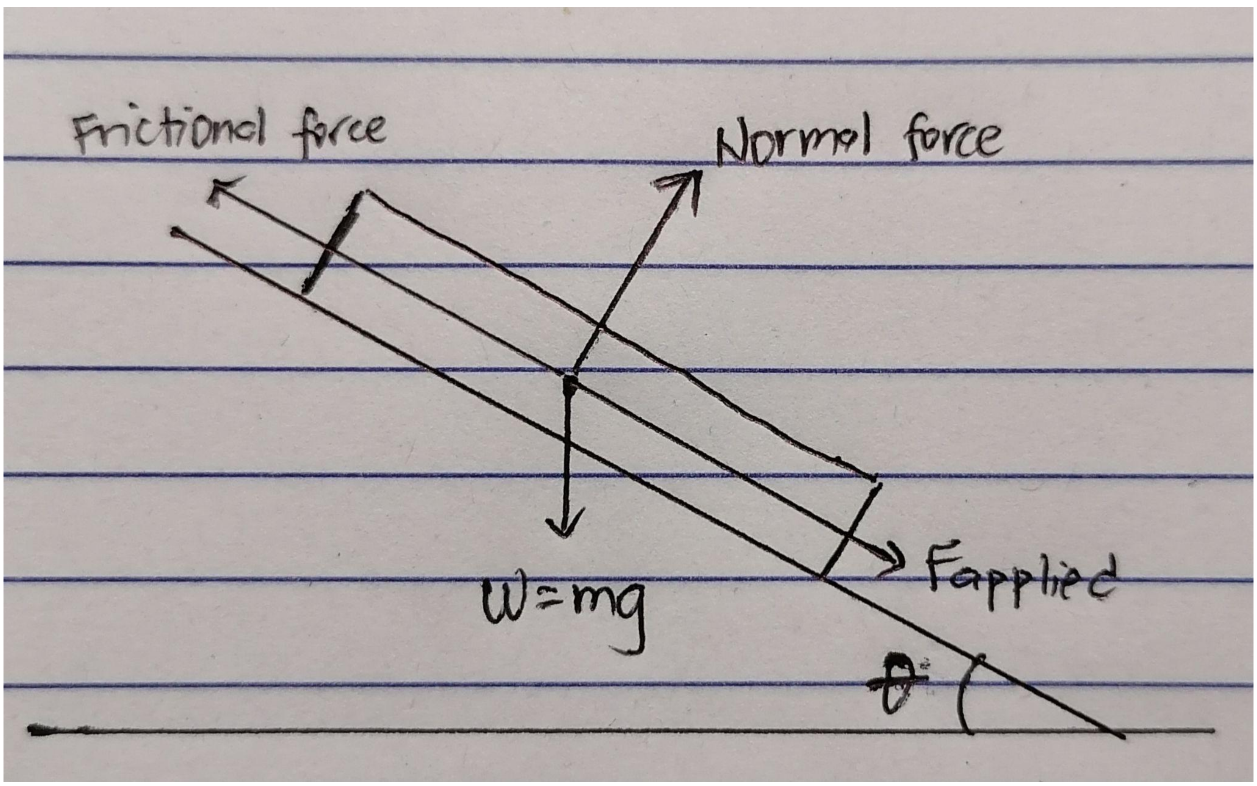
1. The maximum static friction force must be overcome to start slipping. When you start slipping, the coefficient of static friction is much greater than that of kinetic friction, reducing the frictional force to a huge amount. Lesser force is needed to continue the motion, so once you start slipping, it is easier to continue doing so.

2.



3. Using the free-body diagram, we know that

$$\Sigma F_y = 0$$

$$\Sigma F_y = n - mg$$
$$n = mg$$

$$\Sigma F_x = 0$$

$$\Sigma F_x = F - F_{fr}$$

$$F = F_{fr}$$

We also know that the amount of friction an object exerts on another can be calculated using

$$F_{fr} = \mu_s n$$

$$F_{fr} = \mu_s mg$$

From Newton's Second Law of Motion, we know that

$$F = ma$$

Therefore,

$$ma = \mu_s mg$$

Solving for a, we have

$$a = \mu_s g$$

$$a = (0.530)\ (9.8\ m/s^2)$$

$$a = 5.19\ m/s^2$$

To find the shortest time the truck could accelerate uniformly without causing the package to slide, we are going to apply the equation

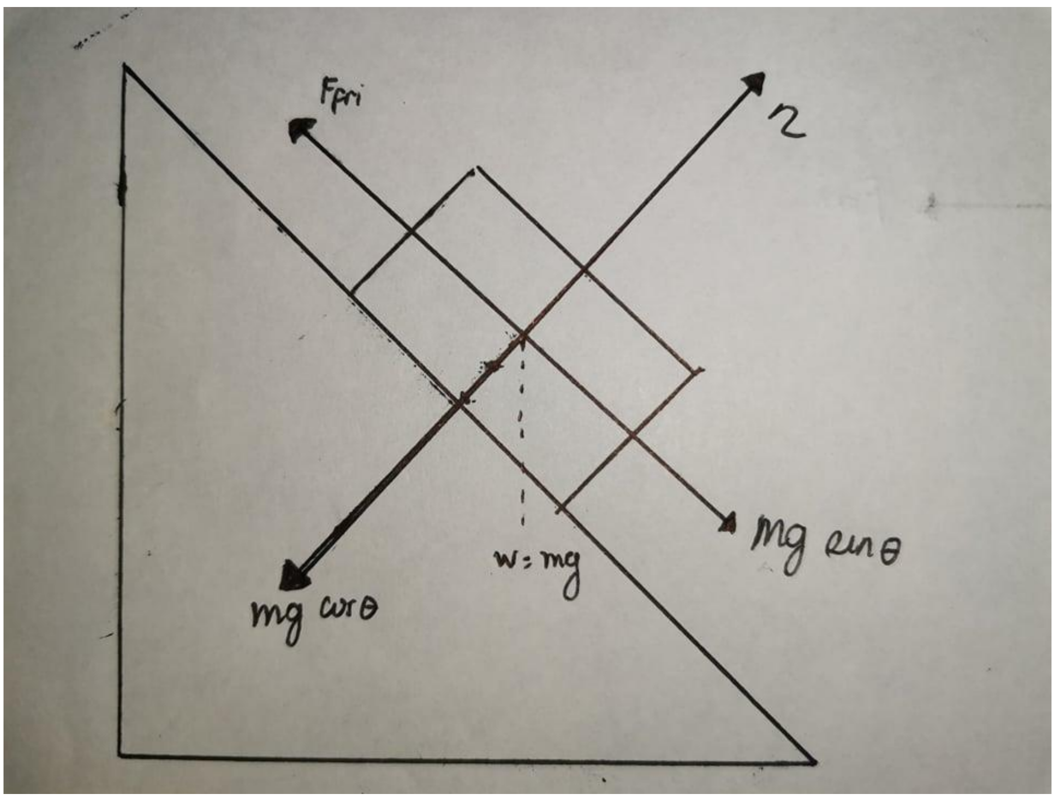
$$v_f = v_i + at$$

$t = (v_f - v_i)/a$

t = 15 m/s / 5.19 m/s^2

t = 2.89 s

4.



5.

$$\Sigma F_x = ma$$

$$\Sigma F_x = F_{fr} - mg \sin \theta$$

$$F_{fr} = mg \sin \theta$$

$$\Sigma F_y = 0$$

$$\Sigma F_y = n - mg \cos \theta$$
$$n = mg \cos \theta$$

We also know that the amount of friction an object exerts on another can be calculated using

$$F_{fr} = \mu_s n$$

$$mg \sin \theta = \mu_s mg \cos \theta$$

Dividing both sides by mg cos θ,

$$\mu_s = \tan \theta$$

Calculating for θ,

$$\theta = tan^{-1} 1$$

$$\boldsymbol{\theta = 45°}$$